Oct. 14, 1969 SATOSHI SHIMADA ET AL 3,472,951

TWO-WAY TELEVISION SYSTEM UTILIZING A COMMON SYNCHRONIZATION SOURCE

Filed Nov. 1, 1965 2 Sheets-Sheet 1

Fig. 1

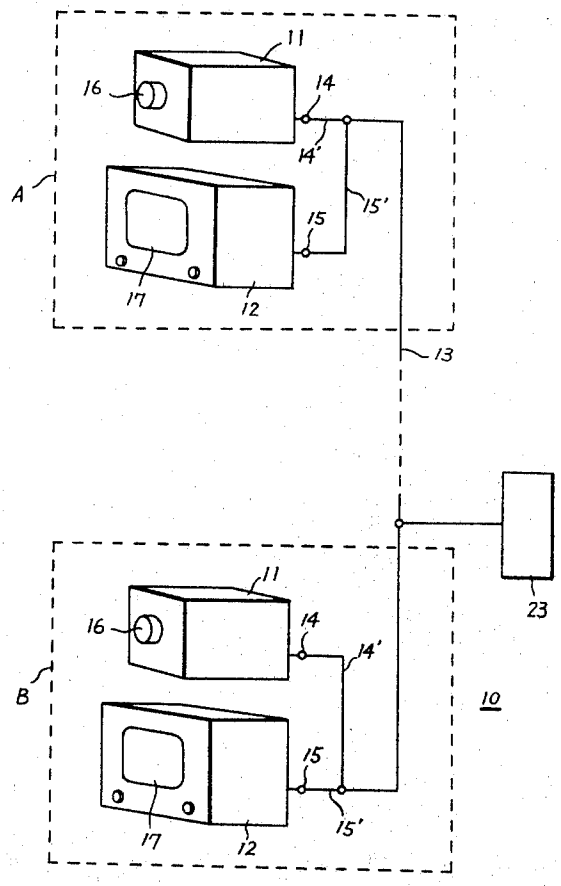
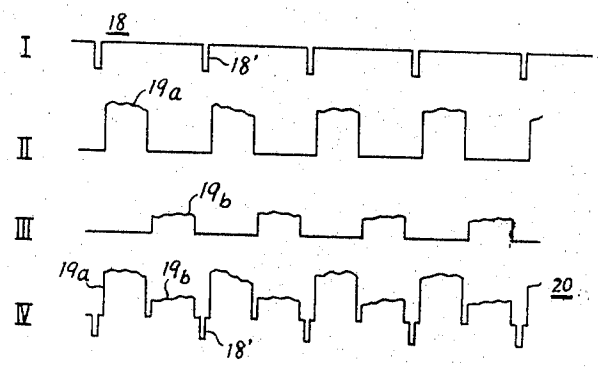


Fig. 2



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Fig - 3

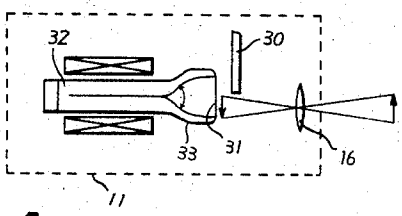


Fig - 4

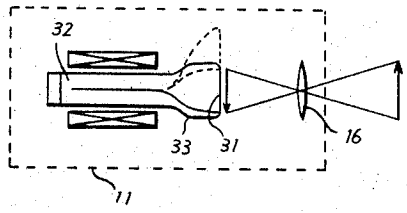


Fig - 5

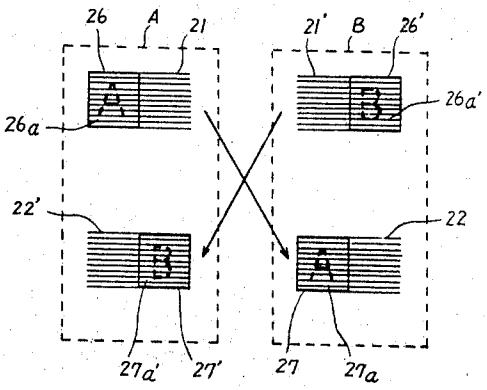
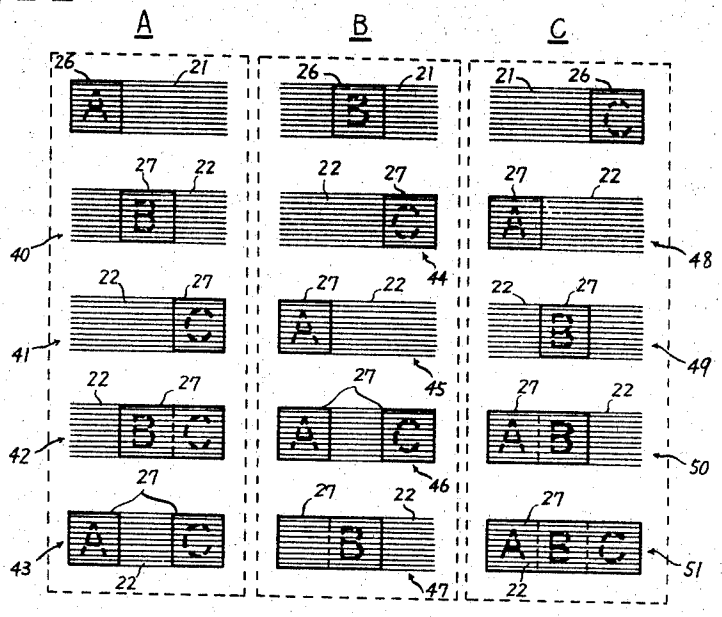


Fig - 6



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TWO-WAY TELEVISION SYSTEM UTILIZING A COMMON SYNCHRONIZATION SOURCE

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Int. Cl. H04n 5/38
U.S. Cl. 178—6.8 13 Claims

ABSTRACT OF THE DISCLOSURE

A television system in which simultaneous video television may be transmitted and received with conventional transmitters and receivers and which uses a single transmission media and a single synchronizing means.

This invention relates to a television system and more particularly to a simultaneous video television system in which two or more video receiving-and-sending stations may simultaneously use a single transmission media. In one application the invention is especially useful in closed circuit television. The invention is also especially adaptable to a closed circuit telephone-video system.

In prior simultaneous video systems at least two cables or transmission loops between the stations have been required. That is, one transmission line between the stations was required to transmit the image sent from each station to the other. While such systems are adequate in many applications, the initial cost of such a system is high and, as the required equipment tends to be complicated, the system maintenance is expensive.

It is therefore an object of the present invention to provide a television system of simplified and economic construction and operation.

It is the primary object of the present invention to provide a new and improved television system which can be employed in a variety of applications.

It is an object of the invention to provide a new and improved television system which can be employed in a closed circuit television which employs only a single transmission cable for the sending of several images from two or more sending stations.

It is another object of the invention to provide novel and better television systems which may be utilized in a closed circuit television system to achieve the result that a plurality of images from different sending stations may be transmitted over a single cable and one or more of the transmitted images may be selectively monitored at one or more receiving stations.

It is another object of the invention to provide a television system which is adaptable to telephone-video use which employs conventional elements in a simple and easily achieved manner to achieve a materially simplified and economical telephone-video system.

In achieving these objects a television system is provided employing at least two stations, each having an image pickup device and an image reproducing device. These devices are provided with synchronization means producing synchronizing pulses and are interconnected by a common transmission medium, such as a single cable or a single channel, and the image pickup devices are operated so as to pick up images during different segments of the periods between synchronizing pulses.

The organization and manner of operation of the invention, together with further objects and advantages thereof may best be understood by reference to the following description taken in connection with the accompanying drawings, in the several figures of which like reference numerals identify like elements, and in which an exemplification of the invention is illustrated.

FIG. 1 is a general schematic diagram illustrating a simultaneous video transmitting system embodying the principles of the invention;

FIG. 2 is a number of waveforms useful in explaining the operation of the system of FIG. 1;

FIG. 3 is a top plan view of part of the apparatus of FIG. 1;

FIG. 4 is a top plan view, similar to FIG. 3 of an alternative construction to that of FIG. 3;

FIG. 5 is a pictorial representation of television video scanned fields illustrating video picture reproduction in the system of FIGS. 1 and 2; and

FIG. 6 is a pictorial representation similar to that of FIG. 5 of a second embodiment of the invention illustrating various applications of the inventive system.

Referring now to FIG. 1 there is depicted a two-station cable-connected television system generally indicated by the numeral **10**. The system **10** includes a first and a second combined pickup and sending station generally indicated by the letters A and B, respectively. Each of the stations A and B comprise an image pickup device **11** and an image reproduction device **12**. The image pickup device **11** may be, as depicted, an entirely conventional television camera having an optical lens system **16**. The device or camera **11** includes a pickup tube such as the vidicon, the iconoscope, the image orthicon, or the like which converts the image from the lens system **16** into a transmittable electrical waveform which is supplied at an output **14**. The image reproduction device **12** may be a conventionally constructed television receiver having a signal input terminal **15** and an image displaying cathode ray tube **17**.

When the system **10** is adapted to be a telephone-video system, the camera **11** and receiver **12** of each station A and B are placed facing a common area of use. In this area, the user at one station may stand or sit so as to be seen and to see the user at the other station.

The image signals of the pickup device **11** at the station A must be transmitted to the reproducing device **12** at the station B. On the other hand, the image signals of the pickup device **11** at station B must be transmitted, to the reproducing device **12** at station A.

According to this invention, these image signals are transmitted simultaneously with only a single transmission media, the electric input transmitting cable **13**. That is, at each station A, B, the output terminal **14** of the pickup device **11** and the input terminal **15** of the image reproducing device **12** are coupled to the cable **13** via, respectively, electrical lines **14'** and **15'** which are connected to one another, and this common connection is connected to one end of the transmission cable **13** which interconnects the two stations. Thus, all four devices are intercoupled via a single transmission cable **13**.

Synchronizing pulses, the conventional horizontal and vertical synchronizing pulses, for the pickup devices **11** and the reproducing devices **12**, are supplied from a common synchronizing means or source **23** coupled to the cable **13**. The synchronizing source **23** may be located at any convenient place and may be entirely conventional. The output terminal **14** of the pickup devices **12** serves as the input terminal for the devices illustrated.

Referring to FIG. 2–I, there is depicted the output of synchronizing means **23** a waveform **18**. This conventional waveform comprises a succession of negative pulses **18'** at the line frequency and superimposed pulses (not shown) at the field frequency.

In accordance with the invention the image pickup devices **11** of station A are modified to pick up at substantially only during the left one-half of the horizontal sweep. This can be effected, as shown in FIG. 3, by

inserting a mask **30** over the right one-half of the target area **31** of a vidicon **32** or other tube of the camera **11**. An alternative method of achieving this end is illustrated in FIG. 4 in which the horizontal scan of the vidicon **32** is magnified to twice the horizontal dimension of the target **31** and the phantom half of the horizontal scan is caused to overscan, that is, fall not on the target, on the right side of the ultor **33** of the tube **32**. In either of these ways a signal will be generated only during the left half of the horizontal sweep and no signal will be generated during the right one-half of the horizontal sweep. Thus, an output waveform of the general shape of waveform **19***a* of FIG. 2–II will be generated.

The pickup tube of station B's image pickup device **16** is operated in a similar manner so as to sweep only during substantially the right half of the horizontal sweep. In this manner a signal waveform of the general shape of waveform **19***b* of FIG. 2–III is generated. That is, the video signals **19***a* are aligned at a first half of the period between vertical synchronizing signals **18'**, and video signals **19***b* are aligned at the latter half of the period between synchronizing signals **18'**.

The signal actually present on the cable **13** is the addition of these three waveforms. This composite waveform is of the general form of the waveform **20** depicted in FIG. 2–IV. It should be noted that the respective signals **19***a* and **19***b* occupy slightly less than one-half of the horizontal sweep periods so as to prevent cross-talk between the two signals.

The image reproducing devices **12** of the stations A and B have their input terminals **15** connected to the cable **13** and consequently receive the composite waveform **20** of FIG. 2–IV therefrom. Also in accordance with the invention, the image reproducing device **12** of station B is constructed so as to display on the tube **17** only the left one-half of the horizontal sweep or the portion **19***a* of the waveform **20** generated by pickup device **11** of station A. Likewise, the image reproducing device **12** of station A is constructed so as to display on the tube **17** only the right one-half of each horizontal sweep or the portion **19***b* of the waveform **20** generated by the pickup device **11** of station B. This may be accomplished in the manner of FIG. 3 by masking part of the screen surface of the tube **17** but is preferably accomplished by causing the horizontal sweep to be twice the size of the screen and to place the phantom portion on the right or left side of the ultor of the tube **17**.

It should be noted that if the overscan method of image pickup is used with conventional scan image reproduction, the image is distorted or reduced in width by one-half in the reproduction. In some applications this is permissible, however, in most cases corrective measures should be taken. It is preferred that a consistent system of image pickup and reproduction be used, that is, either both or neither of the pickup and reproducing devices should employ overscanning to prevent distortion.

Referring now to FIG. 5 there is depicted the field swept out and reproduced at the two stations A and B. At the station A, the television camera **11**, either by masking or overscanning, picks up an image **26***a* only on the left one-half **26** of the field **21**. At the station B, its television camera **11** picks up an image **26***a'* from only the right one-half **26'** of the scanned field **21'**. The image reproduction device **12** of station B sweeps out a field **22** received from station A and displays on the tube **12** by either masking or overscanning, only the left one-half **27** and the image **27***a* corresponding to the field half **26** and image **26***a*. In a similar manner, the image reproducer **12** of station A displays only the right one-half **27'** and image **27***a'* corresponding to the field half **26'** and image **26***a'* of station B.

Although the image reproducing devices **17** have been described above as reproducing only the images transmitted from the other station, it is obvious that the entire signal **20** containing both transmitted images of both stations is present at both inputs **15** of the reproducers **12** of both stations A and B. Thus, it is possible for the image reproducing device **12** to display both pictures transmitted from both stations A and B. That is, either station could monitor its own transmission. This could be done, for example, by allowing the entire field **22** or **22'** to be traced out upon the image displaying screen of the tube **17**.

It should be noted that additional image reproducers **12** may be readily affixed to the cable **13** to receive and reproduce one or the other or both of the pictures transmitted from the two stations. Thus, for example, the invention may be readily adapted to a closed-circuit subscription television system to provide the choice of several shows to the subscriber.

Although the invention has been described in conjunction with a two station system, it may be employed in a system employing three or more stations. Referring to FIG. 6, there is illustrated the scanning field of three stations A, B and C. These stations are, as in FIG. 1, connected by a common transmission cable and have a common synchronizing signal source. At the first station A, only the one-third of the field **21** is used to pick up a picture **26**. Likewise, station B uses the central one-third of its scan field **21** to pick up a picture **26**, and station C uses the right one-third of its scan field **21**.

In this three-station system, station A may receive and display only the image transmitted from station B, as shown at **40**, or it may receive and display only the image transmitted from station C, as shown at **41**. Station A may also display both stations B and C transmitted images, as shown at **42**, or it may monitor its own transmission and display one or the other or both of the transmissions of stations B and C. As an example, it may display or monitor its own transmission and display the transmission of station C, as shown at **43**. Station B may similarly display only the transmittal of station C (**44**) or A (**45**) or both (**46**). It may also monitor its own transmittal and display one or both of the transmittals of stations A and C, for example, that of station A as shown at **47**. Also station C may display only the transmittal of one of the other two stations, as at **48** and **49**, or it may display both as at **50**. Station C may similarly monitor its own transmittal as well as display one or both (as at **51**) of the other station's transmittals.

As is now apparent, a new and improved television system has been described which can be employed in a variety of applications. The described invention is of simplified and economic construction and operation in that it eliminates the requirement for a plurality of transmission cables or channels and provides for using a common synchronizing signal source for two or more transmittal-receiving stations.

It will be apparent that many modifications and variations may be effected without departing from the scope and the novel concepts of the present invention.

We claim as our invention:

1. A television system comprising:

a first station having a first image pickup device for producing a video output signal and a first image reproducing device for reproducing an image from an input signal;

a second station having a second image pickup device for producing a video output signal and a second image reproduction device for reproducing an image from an input signal;

an electrical circuit interconnection between said first and said second station;

a single synchronizing means for producing a synchronizing signal including horizontal synchronizing pulses connected to deliver said signal to said electrical circuit interconnection;

means for intercoupling said circuit interconnection and said first pickup device and said first reproducing device at said first station, means for intercoupling

said circuit interconnection and said second pickup device and said second reproducing device at said second station; and

means for operating said pickup devices so as to pick up an image during different segments of the periods between said horizontal synchronizing pulses of said synchronizing signal.

2. A television system comprising:

a first image pickup device having an output terminal for producing a video signal at said terminal;

a second image pickup device having an output terminal for producing a video signal at said terminal;

an image reproducing device, having an input terminal for reproducing an image from a video signal applied at said input terminal;

a single source of synchronizing pulses including horizontal synchronizing pulses;

a single transmission medium;

means for coupling said output signal of each of said pickup devices, the input of said reproducing device and the synchronizing signal of said source to said medium; and

means at each of said pickup devices operatively connected thereto for having said devices pick up an image at only different portions of the period between said horizontal synchronizing pulses.

3. The television system as claimed in claim 2 in which said image pickup devices each includes a television pickup tube and said means at one of said pickup devices includes a mask covering a portion of the image input of said tube.

4. The television system as claimed in claim 2 in which said image pickup devices each includes a television pickup tube and said means at one of said pickup devices includes means for causing said tube to horizontally overscan for the same position of each horizontal scan.

5. The television system as claimed in claim 2 in which said medium comprises a single electrical cable interconnecting said first and said second pickup devices.

6. A television system comprising:

a first station including an image pickup device for producing a video signal at an output terminal, and an image reproducing device for reproducing an image from a video signal received at an input terminal of said reproducing device;

a second station including an image pickup device for producing a video signal at an output terminal, and an image reproducing device for reproducing an image from a video signal received at an input terminal of said reproducing device;

a signal transmitting cable interconnecting said first station and said second station;

a single source of synchronizing signals, including horizontal synchronizing pulses electrically coupled to said cable;

means electrically coupling said output terminal of said pickup device of said first station to said cable;

means electrically coupling said output terminal of said pickup device of said second station to said cable;

means electrically coupling said input of said image reproducing device of said first station to said cable;

means electrically coupling said input of said image reproducing device of said second station to said cable;

means at said pickup device of said first station for having said pickup device pick up an image at only a first portion of each horizontal scan period between said horizontal synchronizing pulses; and

means at said pickup device of said second station for having said pickup device pick up an image at only a second portion, different from said first portion, of each horizontal scan period between said horizontal synchronizing pulses.

7. The television system as claimed in claim 6 in which said image pickup devices each includes a television pickup tube and said means at one of said pickup devices includes a mask covering a portion of the image input of said tube.

8. The television system as claimed in claim 6 in which said image pickup devices each includes a television pickup tube and said means at one of said pickup devices includes means for causing said tube to horizontally overscan for the same position of each horizontal scan.

9. The television system as claimed in claim 6 in which said first portion of each horizontal scan is approximately the first one-half of said scan and said second portion of said each horizontal scan is approximately the second one-half of said scan.

10. The television system as claimed in claim 6 in which said first and second portions are each different approximately one-third of said each horizontal scan.

11. The television system as claimed in claim 6 in which said reproducing device of said first station reproduces and displays the image picked up by said pickup device of said second station and said reproducing device of said second station reproduces and displaces the image picked up by said pickup device of said first station.

12. A television system comprising:

a first station including an image pickup device for producing a video signal at an output terminal, said pickup device including a television camera tube, and an image reproducing device, said image reproducing device including a display cathode ray tube, for reproducing an image from a video signal received at an input terminal of said reproducing device;

a second station remotely located from said first station including a television camera tube, and an image reproducing device, said image reproducing device including a display cathode ray tube, for reproducing an image from a video signal received at an input terminal of said reproducing device;

a signal transmitting cable interconnecting said first station and said second station;

a single source of synchronizing signals including horizontal synchronizing pulses electrically coupled to said cable for transmitting said synchronizing signals through said cable to said stations;

means electrically coupling said output terminal of said pickup device at said first station to said cable for utilizing said synchronizing signals and for transmitting said video signal to said cable;

means electrically coupling said output terminal of said pickup device of said second station to said cable utilizing said synchronizing signals and for transmitting said video signal to said cable;

means electrically coupling said input of said image reproducing device of said first station to said cable for reproducing and displaying, using said synchronizing signals and at least part of the video signals transmitted on said cable, an image;

means electrically coupling said input of said image reproducing device of said second station to said cable, for reproducing and displaying, using said synchronizing signals and at least part of the video signals transmitted on said cable, an image;

means at said pickup device of said first station for having said pickup device pick up an image at only a first portion of each horizontal scan period between said horizontal synchronizing pulses, said first portion being approximately equal to the first one-half of said scan; and

means at said pickup device of said second station for having said pickup device pick up an image at only a second portion, different from said first portion, of each horizontal scan period between said horizontal synchronizing pulses, said second portion being approximately equal to the second one-half of said scan.

13. A television system comprising:

a first station including an image pickup device for producing a video signal at an output terminal, said pick-

up device including a television camera tube and an image reproducing device, said image reproducing device including a display cathode ray tube for reproducing an image from a video signal received at an input terminal of said reproducing device;

a second station remotely located from said first station including an image pickup device for producing a video signal at an output terminal, said pickup device including a television camera tube and an image reproducing device, said image reproducing device including a display cathode ray tube for reproducing an image from a video signal received at an input terminal of said reproducing device;

a signal transmitting cable interconnecting said first station and said second station;

a single source of synchronizing signals, including horizontal synchronizing pulses electrically coupled to said cable for transmitting said synchronizing signals through said cable to said stations;

means electrically coupling said output terminal of said pickup device at said first station to said cable for utilizing said synchronizing signals and for transmitting said video signal to said cable;

means electrically coupling said output terminal of said pickup device of said second station to said cable for utilizing said synchronizing signals and for transmiting said video signal to said cable;

means electrically coupling said input of said image reproducing device of said first station to said cable for reproducing and displaying, using said synchronizing signals and at least part of the video signals transmitted on said cable, an image;

means electrically coupling said input of said image reproducing device of said second station to said cable for reproducing and displaying, using said synchronizing signals and at least part of the video signals transmitted on said cable, an image;

means at said pickup device of said first station for having said pickup device pick up an image at only a first portion of each horizontal scan period between said horizontal synchronizing pulses, said first portion being approximately equal to the first one-third of said scan; and

means at said pickup device of said second station for having said pickup device pick up an image at only a second portion, different from said first portion of each horizontal scan period between said horizontal synchronizing pulses, said second portion being approximately equal to the second one-third portion of said scan.

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U.S. Cl. X.R.

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